Claims

1. A wave energy converter comprising:

a central body including a nacelle, the nacelle having a first side, a second side, and a longitudinal axis, the nacelle housing at least one power take off;

a first float and a first float arm coupled to the nacelle on the first side;

a second float and a second float arm coupled to the nacelle on the second side;

wherein the first float is rotatably coupled to the nacelle, the first float and the first float arm forming a first body configured to rotate about the longitudinal axis, wherein the first body is operatively coupled to the at least one power take off such that relative motion between the first body and the central body generates energy in the at least one power take off; and

wherein the central body has a low reserve buoyancy, wherein the reserve buoyancy of the central body is lower than the reserve buoyancy of either of the first float and the second float, to minimize a heave response of the central body relative to the first float to increase output of the wave energy converter.

2. The wave energy converter of claim 1, wherein the second float is rotatably coupled to the nacelle, the second float and the second float arm forming a second body configured to rotate about the longitudinal axis, wherein the second body is operatively coupled to the at least one power take off such that relative motion between the second body and the central body generates energy in the at least one power take off.

3. The wave energy converter of claim 1, wherein the central body has a low reserve buoyancy such that in the event that the first float rotates to the second side of the nacelle, the first float is self-restoring back to the first side.

4. The wave energy converter of claim 2, wherein the central body has a low reserve buoyancy such that in the event that either the first float rotates to the second side of the nacelle, or the second float rotates to the first side of the nacelle, both the first float and the second float are self-restoring back to their respective first and second sides.

5. The wave energy converter of claim 1, wherein the reserve buoyancy of the central body is less than 45%, such that at least 55% of the central body is positioned under a still water line.

6. The wave energy converter of claim 1, wherein the nacelle, the first float, and the second float each have a substantially cylindrical shaped body.

7. The wave energy converter of claim 1, wherein the second float arm is longer than the first float arm.

8. The wave energy converter of claim 1, wherein the first float is nestable within the second float.

9. The wave energy converter of claim 1, wherein the nacelle further comprises:

a nacelle tube having a first end extending outwardly from a first side of the nacelle and a second end extending outwardly from a second side of the nacelle;

wherein the first float arm includes a primary first float arm rotatably coupled to the first side of the nacelle tube, and a secondary first float arm rotatably coupled to the second side of the nacelle tube; and

wherein the second float arm includes a primary second float arm rotatably coupled to the first side of the nacelle tube, and a secondary second float arm rotatably coupled to the second side of the nacelle tube.

10. The wave energy converter of claim 1, wherein the central body further comprises:

a plurality of lines extending downwardly from the nacelle; and

a heave plate attached to the plurality of lines.

11. The wave energy converter of claim 10, wherein the central body further comprises:

a yoke extending downwardly from the nacelle; and

wherein the plurality of lines attach to the base of the yoke, each of the plurality of lines having a lower terminus, where the heave plate is attached to the lower terminus of each of the plurality of lines.

12. The wave energy converter of claim 11, wherein the central body further comprises:

a yoke plate extending substantially the length of the yoke.

13. The wave energy converter of claim 1, further comprising:

an energy storage device, wherein the energy storage device is configured to be coupled to the at least one power take off.

14. The wave energy converter of claim 1, further comprising:

at least one line extending downwardly from the nacelle, wherein the at least one line includes at least one of a mooring line and an electro-opto-mechanical (EOM) cable.

15. The wave energy converter of claim 14, in combination with a base unit, the base unit comprising:

an anchoring element which is configured to position the base unit on an ocean floor;

an energy storage device associated with the anchoring element, wherein the energy storage device is configured to be coupled to the EOM cable;

a payload interface unit associated with the anchoring element, wherein the payload interface unit is configured for distribution of power, wired signals and/or wireless signals; and

wherein the combination of the wave energy converter and the base unit form an autonomous offshore power system (AOPS) which can provide power generation, energy storage and real-time data communication.

16. The wave energy converter of claim 2, wherein the at least one power take off includes a first power take off and a second power take off, wherein the first body is

operatively coupled to the first power take off through the first float arm and the second body is operatively coupled to the second power take off through the second float arm.

17. The wave energy converter of claim 16, wherein the first and second power take offs each have a rotor assembly and a stator assembly, and wherein the rotor assemblies of the first power take off and the second power take off rotate about the longitudinal axis.

18. A wave energy converter comprising:

a central body including a nacelle, the nacelle having a first side, a second side, and a longitudinal axis, the nacelle housing at least one power take off;

a first float and a first float arm coupled to the nacelle on the first side;

a second float and a second float arm coupled to the nacelle on the second side;

wherein the first float is rotatably coupled to the nacelle, the first float and the first float arm forming a first body configured to rotate about the longitudinal axis, wherein the first body is operatively coupled to the at least one power take off such that relative motion between the first body and the central body generates energy in the at least one power take off;

wherein the central body further comprises:

a yoke extending downwardly from the nacelle;

a plurality of lines attached to the base of the yoke and extending downwardly, each of the plurality of lines have a lower terminus; and

a heave plate attached to the lower terminus of each of the plurality of lines, wherein the heave plate and lines attached to the lower portion of the yoke tend to reduce rotation of the nacelle,

wherein the second float is rotatably coupled to the nacelle, the second float and the second float arm forming a second body configured to rotate about the longitudinal axis, wherein the second body is operatively coupled to the at least one power take off such that relative motion between the second body and the central body generates energy in the at least one power take off,

wherein the central body has a low reserve buoyancy, and wherein the reserve buoyancy of the nacelle is lower than the reserve buoyancy of either of the first float and the second float, such that in the event that either the first float rotates to the second side of the nacelle, or the second float rotates to the first side of the nacelle, both the first float and the second float are self-restoring back to their respective first and second sides.

19. The wave energy converter of claim 18, wherein the central body further comprises:

a yoke plate extending substantially the length of the yoke.

20. The wave energy converter of claim 18, wherein the nacelle, the first float, and the second float each have a substantially cylindrical shaped body.

21. The wave energy converter of claim 18, wherein the second float arm is longer than the first float arm.

22. The wave energy converter of claim 18, wherein the first float is nestable within the second float.

23. The wave energy converter of claim 18, wherein the nacelle further comprises:

a nacelle tube having a first end extending outwardly from a first side of the nacelle and a second end extending outwardly from a second side of the nacelle;

wherein the first float arm includes a first forward float arm rotatably coupled to the first side of the nacelle tube, and a second forward float arm rotatably coupled to the second side of the nacelle tube; and

wherein the second float arm includes a first aft float arm rotatably coupled to the first side of the nacelle tube, and a second aft float arm rotatably coupled to the second side of the nacelle tube.

24. The wave energy converter of claim 18, further comprising:

an energy storage device, wherein the energy storage device is configured to be coupled to the at least one power take off.

25. The wave energy converter of claim 18, further comprising:

at least one line extending downwardly from the nacelle to the heave plate, wherein the at least one line includes at least one of a mooring line and an electro-opto-mechanical (EOM) cable.

26. The wave energy converter of claim 25, in combination with a base unit, the base unit comprising:

an anchoring element which is configured to position the base unit on an ocean floor;

an energy storage device associated with the anchoring element, wherein the energy storage device is configured to be coupled to the EOM cable;

a payload interface unit associated with the anchoring element, wherein the payload interface unit is configured for distribution of power, wired signals and/or wireless signals; and

wherein the combination of the wave energy converter and the base unit form an autonomous offshore power system (AOPS) which can provide power generation, energy storage and real-time data communication.

27. The wave energy converter of claim 18, wherein the at least one power take off includes a first power take off and a second power take off, wherein the first body is operatively coupled to the first power take off through the first float arm and the second body is operatively coupled to the second power take off through the second float arm.

28. The wave energy converter of claim 27, wherein the first and second power take offs each have a rotor assembly and a stator assembly, and wherein the rotor assemblies of the first power take off and the second power take off rotate about the longitudinal axis.